RAYMOND CON-CRETE Piling

RAYMOND
Concrete Pile Company

CONCRETE
PILE CONSTRUCTION

General Offices
135 Adams Street, Chicago, Illinois

New York Office, 71 Nassau Street

THE Raymond Systems of Concrete Piling are fully protected by Letters Patent of the United States and of all the principal foreign countries. Any infringements will be prosecuted to the fullest extent of the law.

The Raymond System of Concrete Piling.

The introduction of concrete piles marked a new era in foundation construction. No argument was needed to convince the thorough Engineer that a practical system of concrete piling, which could be depended upon for durability and strength, and at a cost much less than that of caissons, would have a wide field of usefulness.

The first and only practical system to be tested in this country was invented by Mr. A. A. Raymond, and was demonstrated in April, 1901. The first actual work was performed in June of the same year and justified all the claims made by the inventor. Since that time the Raymond System has forged ahead, reaching new fields and making friends everywhere in the engineering world.

Every Engineer and Architect who has carefully studied the subject has recognized the value and superiority of Raymond piles. Those who have had occasion to use them speak unhesitatingly in their favor. We are pleased to refer to any and all who have used the system, knowing full well that only satisfactory and efficient work has been performed.

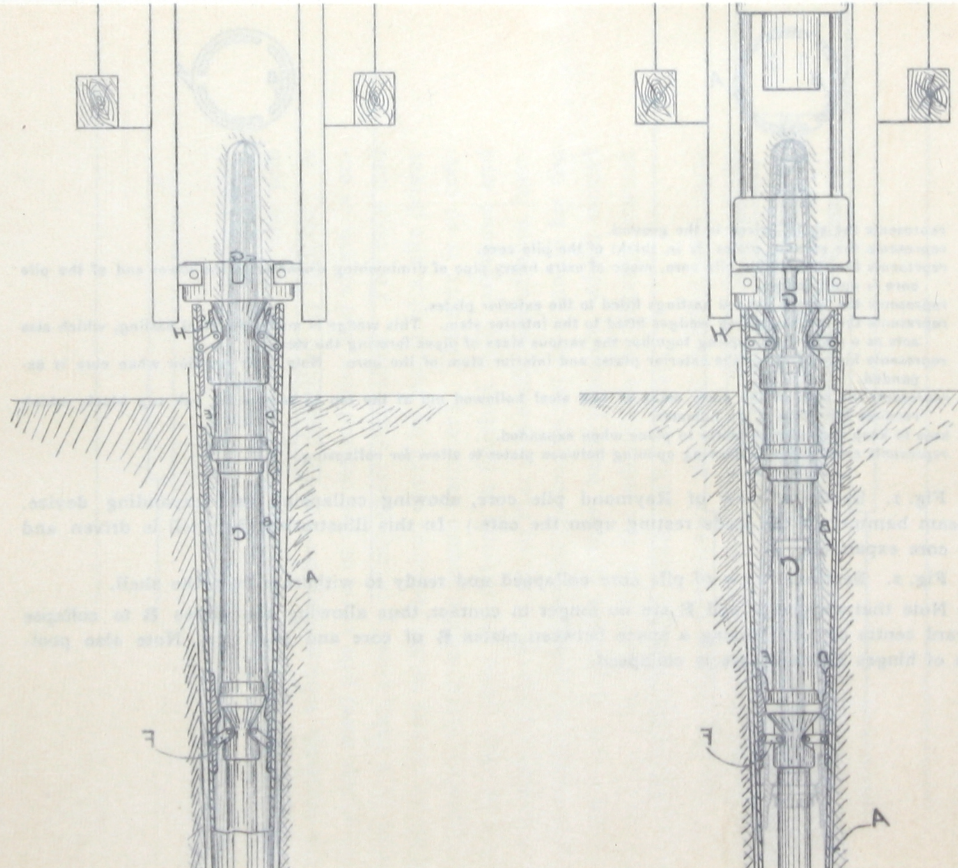
Since the previous edition of our catalogue was published many thousand Raymond piles have been placed by the Company and its representatives, and the work has been distributed over the greater part of the United States. Many new and difficult conditions have been encountered, but in every case the work has been accomplished with entire success.

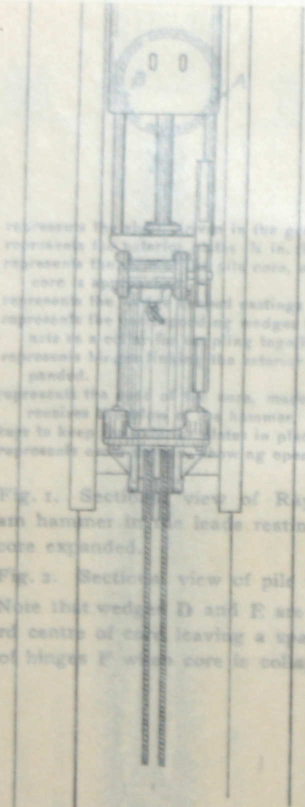
The great success of Raymond piles is due to the correctness of the fundamental principle upon which these piles are based: "A shell or form for every pile." It has been demonstrated beyond a reasonable doubt that to be certain of a perfect concrete pile under any and all conditions, there must be a form which remains in the ground and protects the concrete until it has firmly set. In the Raymond System this form is of a size and shape best suited to secure the greatest possible bearing value. The form (which is of sheet steel) is driven by means of a collapsible steel core until it is practically impossible to secure further penetration. The core is then withdrawn, leaving the shell (which is of sufficient strength to retain its size and shape as driven) in the ground to act as a mould for the concrete. The shell is inspected and filled with thoroughly mixed Portland cement concrete, which is carefully tamped in the shell as it is filled. (See page 6.)

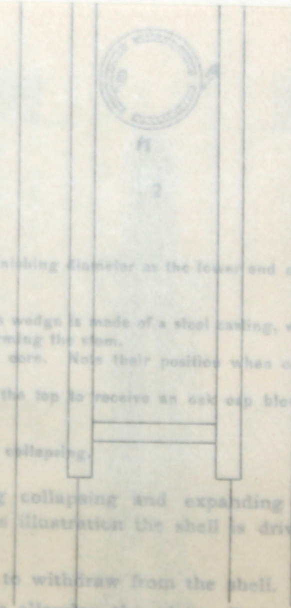
We feel that we cannot too strongly urge the importance of this protecting form. True, in some isolated instances a perfect pile could be obtained without the use of a form. But in ninety per cent. of the cases where concrete piles are needed, a form is absolutely essential to complete success.

Our facilities for handling work have been and are constantly being increased by the addition of new equipment, which is widely distributed throughout the United States, and we are, therefore, in a position to handle work at any point promptly and satisfactorily.

We invite a careful study of the details of our system as shown in this catalogue, of the demonstrations of the superiority of Raymond piles, and of the testimonials of those who have made practical use of them.







A represents the shell driven in the ground.
B represents the exterior plates (¼ in. thick) of the pile core.
C represents the stem of the pile core, made of extra heavy pipe of diminishing diameter as the lower end of the pile core is approached.
D represents the collapsing wedge castings fitted to the exterior plates.
E represents the corresponding wedges fitted to the interior stem. This wedge is made of a steel casting, which also acts as a collar for coupling together the various sizes of pipes forming the stem.
F represents hinges linking the exterior plates and interior stem of the core. Note their position when core is expanded.
G represents the head of the core, made of cast steel hollowed out at the top to receive an oak cap block, which receives the blow of the hammer.
H keys to keep the exterior plates in place when expanded.
K represents cross section showing opening between plates to allow for collapsing.

FIG. 1. Sectional view of Raymond pile core, showing collapsing and expanding device. (Steam hammer in the leads resting upon the core.) In this illustration the shell is driven and the core expanded.

FIG. 2. Sectional view of pile core collapsed and ready to withdraw from the shell.

Note that wedges D and E are no longer in contact, thus allowing the plates B to collapse toward centre of core leaving a space between plates B of core and shell A. Note also position of hinges F when core is collapsed.

The Method.

Raymond Concrete Piles are usually placed by the pile core method, which may be briefly described as follows: A collapsible steel pile core, of the desired size and shape, is encased in a thin, closely fitting sheet steel shell. The core and shell are driven to the required depth by means of a pile driver (preferably fitted with a steam hammer). The core is so constructed that when the driving is finished, it is collapsed and loses contact with the shell, so that it is easily withdrawn, leaving the shell or casing in the ground to act as a mould for the concrete and to protect it from back pressure, which would distort the pile, and from the admixture of foreign matter which would destroy the bond of the concrete.

When the core is withdrawn, the shell is filled with carefully mixed Portland cement concrete, which is carefully tamped during the filling process.

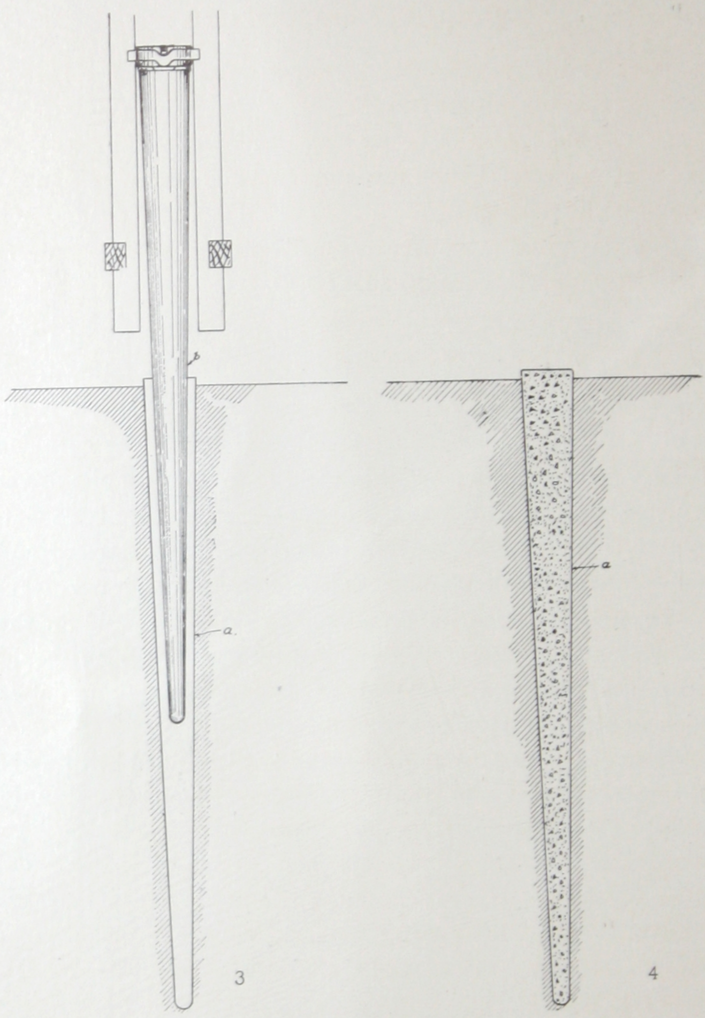


Fig. 3. Pile core collapsed and partly withdrawn from the shell. The shell remains in the ground and forms a mould for the concrete, assuring a perfect pile.

Fig. 4. A completed Raymond Concrete Pile, without reinforcement.

Points of Superiority.

Raymond Concrete Piles are superior to any other concrete piles for the following reasons:

(1) A shell or form is used for every pile. This form can be easily inspected before the concrete is deposited and assures perfection in each pile.

(2) Raymond piles are of a size and shape to develop the greatest possible bearing value.

(3) They can be easily reinforced.

(4) They can be more rapidly placed than any other concrete piles.

(5) There is no driving on the concrete and therefore no possibility of fracture.

The Shell.

We are pleased to note the growing appreciation among Engineers and Architects of the importance of the shell or form, the employment of which, to protect the concrete from the back pressure of the material penetrated and to exclude all foreign matter, is the distinctive feature of the Raymond System. It is now almost universally recognized that the use of this shell is of the utmost importance and cannot be too greatly emphasized. It is the feature which makes the Raymond pile the ONE concrete pile that can be depended upon absolutely to meet the most severe requirements. It is ABSOLUTE CERTAINTY versus UNCERTAINTY. It is WORKING IN THE LIGHT OF DAY versus WORKING IN THE DARK.

No careful Engineer or Architect will permit green concrete to be placed in quicksand, silt, soft mud or any porous or un-

stable material without the protection of a form. It is of still greater importance that it be protected when placed below the surface of the ground where the pressure is often very great.

Attempts have been made to construct concrete piles in place in the ground without using a protecting form, and while in a few cases, where the soil was particularly good, no bad results have been apparent, in all too many other cases such attempts have been disastrous and have resulted in heavy pecuniary loss as well as loss of time. It is not enough to know that a quantity of concrete equal to the cubic capacity of the hole made has been deposited therein; for it has been demonstrated by excavating piles so made that they are often of widely varying diameter, due to the unequal pressure of the different strata of soil displaced—the diametric measurements of such piles varying in some cases from three feet to five or six inches. This variation, which in most soils is inevitable when no form is used as a protection against the unequal pressures, is likely to be still further accentuated by the driving of a closely contiguous pile. Failure to secure uniform results cannot occur where a shell or protecting form is used, as this shell is of sufficient strength to withstand the soil pressure when the core is withdrawn and, when filled with concrete, to withstand the additional pressure caused by driving adjacent piles.

The Tapering Shape.

Our varied experience has confirmed the contention that for most foundation work large, tapering piles are the best and most economical. Where piling is necessary the soil is usually poor—often the best stratum is that on or near the surface. In most soils large, tapering concrete piles, 18″ or 20″ in diam-

eter at the top and 6″ or 8″ in diameter at the point, are very much more effective than straight piles of greater length; particularly where a comparatively hard stratum is underlaid by softer material. In New York City, 25-foot tapering piles were found to be equal to 40-foot piles of uniform diameter. At Salem, Mass., 20-foot piles, tapering from 20″ at the top to 6″ at the bottom, developed greater bearing value than 35-foot piles with less taper and larger point. In New Orleans, 20-foot piles of the size just mentioned were found to be equal to 50 and 60-foot wooden piles, which, while large, were nearly straight. At Boston, a pile 20 feet in length, 20″ at the top, and 6″ at the bottom, while it required a less total number of blows to drive, offered more final resistance than a 20-foot pile of the same length, 18″ at the top and 13″ at the point. The explanation of this is simple and obvious. It lies in the fact that in the case of a tapered pile the load is more uniformly distributed throughout its entire length, while in that of a straight pile it is largely concentrated upon the limited area of the point. Thus, where a pile penetrates the hard stratum lying near the surface and into the softer underlying material, the bearing value of this upper stratum is fully developed by the large, tapering wedge-shaped pile, while it would be almost lost with the pile straight, or nearly so.

Ease of Reinforcement.

The reinforcement of concrete piles by steel rods is sometimes found to be desirable for certain uses. This is always a simple matter with the Raymond System. Whether the shell or casing, which is always used, is jetted into place or driven, the insertion of the reinforcing material is done when the

concrete is put in, and is simple, is in plain sight, and requires no unusual skill.

Saving of Time.

The question of time is always an important one in building construction. Raymond piles can unquestionably be placed more rapidly than any other concrete piles, as when the shell is driven the core is easily and quickly withdrawn, and the driver turned to drive another shell while the one already driven is being filled. As compared with wooden piles the economy of time is very considerable, as a much smaller number of piles is required, and the time required to do the expensive excavating, sheeting and pumping, as well as to put in additional masonry, is saved.

As rapidity of work is always more or less governed by local conditions, such as the character of the soil to be penetrated, and the length and spacing of the piles, it is not possible to give accurate figures suitable to all conditions of work. Depending upon these conditions, the number that can be put in with one driver may vary from ten to forty per day.

The Driving.

Numerous attempts have been made to build and afterward drive the actual concrete pile. But these attempts have met with only a limited success. Such piles require in their manufacture heavy reinforcement with steel rods, which makes them expensive, and when driven they cannot stand a hard blow of the hammer without fracture. Under the Raymond System there is no driving on the concrete. A steel pile core, carrying a sheet-metal shell, is driven as described on page 5; the core

is then withdrawn, and the shell afterward filled with concrete, which sets or hardens in place.

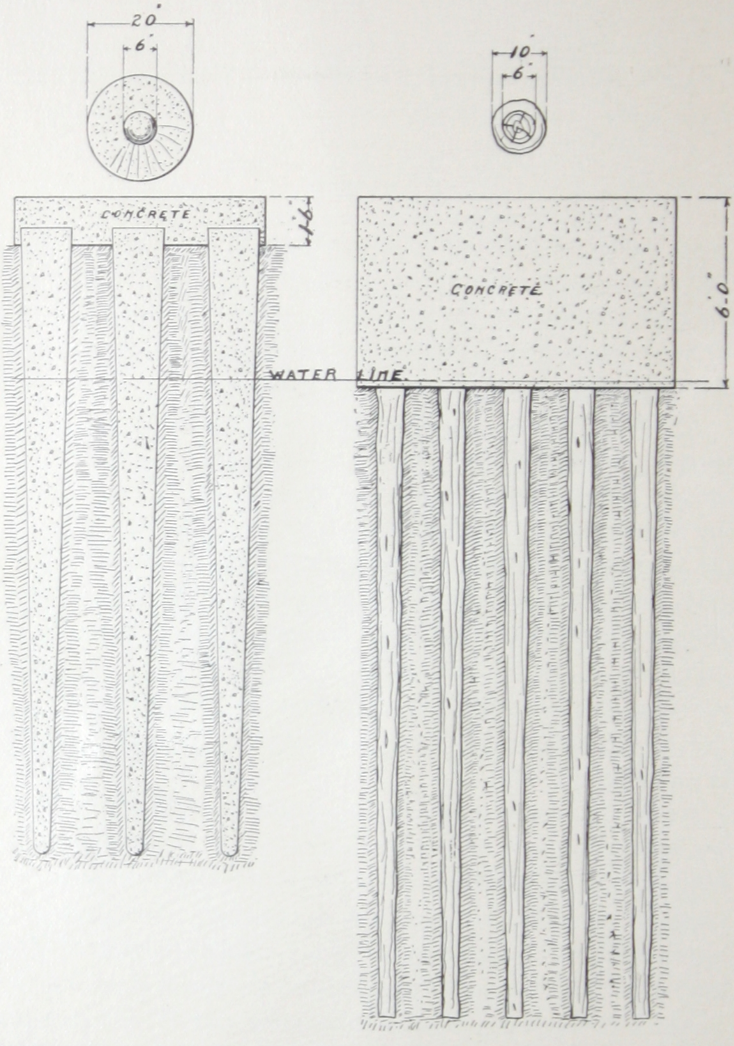
Economy.

As Raymond Concrete Piles are made where they are used, their cost varies, depending upon the cost of transporting machinery to the site, the availability of material, the character of the soil to be penetrated, the number and spacing of the piles, and the general labor conditions of each locality.

While concrete piles necessarily cost more per lineal foot than wooden piling, the economy in the use of concrete piles as against wooden piles is very considerable. It is due, first, to the much smaller number of concrete piles required to carry the necessary load, one concrete pile having, on account of its great size and taper, practically the carrying capacity of three ordinary wooden piles of the same length; and, secondly, to the great saving of excavation, sheeting, pumping and masonry so generally required where wooden piles are used.

The illustrations on pages 12, 13 and 14 show very fully the saving effected.

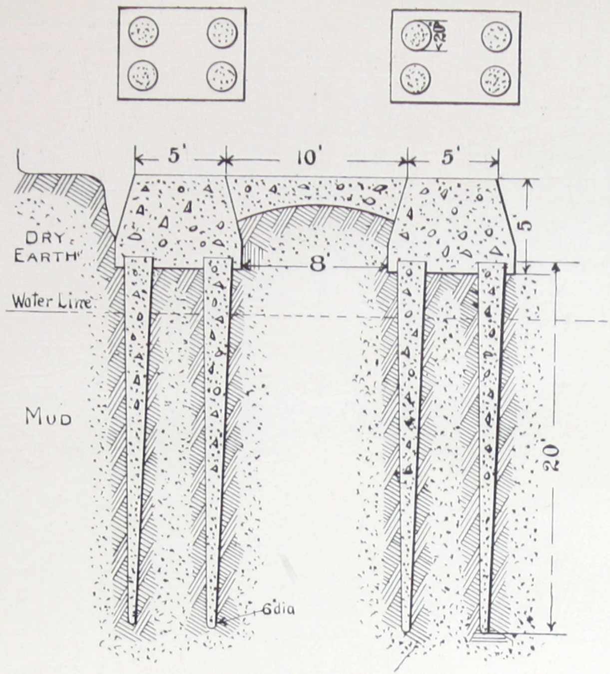
As to the economy in the use of Raymond Concrete Piles, we refer to the letters of Architects contained in this catalogue. In the work done for the United States Naval Academy at Annapolis, a saving of more than $27,000 was made over the estimated cost of a foundation using wooden piles according to the original plan. For a detailed statement showing the comparative cost of wood and concrete pile foundations for this work, see the article by Mr. W. R. Harper, reproduced on the last pages of this catalogue.



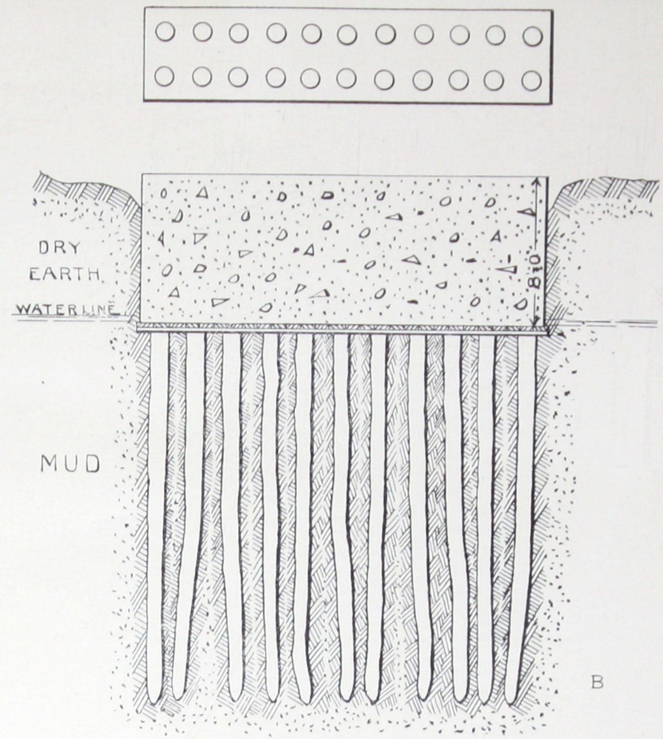
COMPARISON OF CONCRETE PILE WITH WOODEN PILE

Ordinary wooden piles average about 12 inches in diametnr at the top and have 113 square inches of surface. Concrete piles, 20 inches in diameter at the top, have 314 square inches of surface, or 2.77 times that of the wooden pile. The taper of a wooden pile is only about three or four inches from top to bottom, while the taper of the concrete pile is from 10 to 14 inches.

The above illustration gives a fair representation of what may be saved by the use of concrete piles. The three concrete piles, each 20 inches in diameter, have a bearing surface of 942 square inches, while the five wooden piles, each 12 inches in diameter (which is a fair average), have a bearing surface of 565 square inches. Note the additional concrete required on top of the wooden piles, which must be cut off below water line to insure their permanency. It is also frequently necessary to drive sheet piling around the trenches in order to make the excavation to water line.



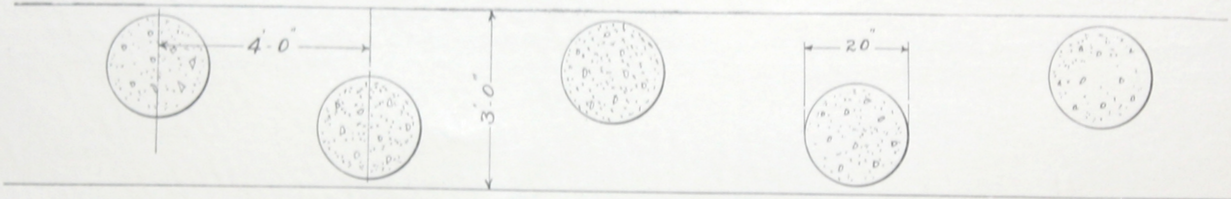
A



B

A. Concrete piles in piers joined by concrete arches, as built for the J. I. Case Plow Works, Racine, Wis. In this work we guaranteed to sustain the required load. Single piles and a pier of four piles were weighted, the test load remaining on the piles for six days in each instance, without showing any settlement whatever.

B. Contemplated wooden pile plan for the same building, the cost of which would have been fifty per cent. more.



5 CONCRETE PILES 1570 SQ. IN. BEARING SURFACE.

10 WOOD PILES 1130 SQ. IN. BEARING SURFACE.

COMPARISON OF
FIVE CONCRETE PILES
WITH TEN WOODEN PILES

Bearing surface of 5 concrete piles, - -	1,570 square inches
Bearing surface of 10 wooden piles, - - -	1,130 square inches
Difference of - -	440 square inches

in favor of 5 concrete piles over twice as many wooden piles.

The center line of the wall has a bearing on each concrete pile. The foundation of the Bryson apartment building (see page 26), Chicago, was built on the plan shown above.

Comparison of Head Surfaces.

On account of its great taper the Raymond Concrete Pile has a marked advantage in point of economy over all other piles, whether concrete or wood. The following comparison of the head surfaces of piles of different diameters will be of interest:

	Head Surface.
One 20-inch Raymond Pile	314.16 sq. in.
One 18-inch Raymond Pile	254.47 " "
One 10-inch pile	78.54 " "
Four 10-inch piles	314.16 " "
One 12-inch pile	113.09 " "
Three 12-inch piles	339.27 " "
One 14-inch pile	153.93 " "
Two 14-inch piles	307.86 " "
One 16-inch pile	201.06 " "
Three 16-inch piles	603.18 " "
Two 20-inch piles	628.32 " "

It will be noted that a 20-inch Raymond pile has 314.16 square inches head surface, or the same head surface as FOUR 10-INCH PILES, while a 12-inch pile has but 113.09 square inches, a 14-inch pile but 153.93 square inches, and a 16-inch pile but 201.06 square inches. It will be seen further that three 12-inch piles have but 339.27 square inches of head surface, or only 25.11 square inches more than one 20-inch Raymond pile; that two 14-inch piles have but 307.86 square inches, or 6.30 LESS than one 20-inch Raymond pile; and that three 16-inch piles have but 603.18 square inches, or 25.14 square inches LESS head surface than two 20-inch Raymond piles.

Standard Sizes.

The dimensions of the standard sizes of concrete piles placed by the pile core method are as follows:

20	ft.	long,	20	inches	at	the	top	and	6	inches	at the	point
25	"	"	20	"	"	"	"	"	8	"	" "	"
30	"	"	20	"	"	"	"	"	8	"	" "	"
35	"	"	18	"	"	"	"	"	8	"	" "	"
40	"	"	18	"	"	"	"	"	8	"	" "	"

Where rock or hardpan is overlaid by a stratum of soft or unstable material and a pile must be considered as a column, it is, of course, desirable that the point be larger than where the pile depends upon frictional resistance to carry the load. For such uses we have designed cores more nearly straight and are, therefore, prepared to accomplish the best possible results under every condition which may be encountered.

For all ordinary foundation work, where it is not required to go to rock or hardpan, the experience of the Raymond Concrete Pile Company has demonstrated that it is preferable to use the 20-foot length, and if necessary to increase the number of piles, rather than to increase their length, the shorter pile with its greater taper having a greater bearing value per lineal foot of piling than the longer pile. Under such conditions three 20-foot piles have a greater bearing capacity than two 30-foot piles.

Carrying Capacity.

We are often asked to state just what load may safely be placed on a Raymond Concrete Pile. It is manifestly impossible to furnish a table accurately showing the carrying capacity of piles, as the soil is not exactly the same in any two places. All tests which we have made, or which have been made by Architects and Engineers on our work, indicate, however, that from two to three times as much can be placed upon a Raymond Concrete Pile as upon an ordinary wooden pile of the same length under the same conditions. The article in the Engineering Record of March 4, 1905, by Mr. Walter R. Harper, Chief Inspector of the work at the new Naval Academy at Annapolis, which is reproduced on the last pages of this catalogue, bears on this point.

Cost.

Obviously, it is not possible to make fixed or standard prices for Raymond Concrete Piles, as the cost varies widely according to the conditions in each particular case; and so necessary is a knowledge of such conditions in making estimates, that we refrain from giving any figures here, even in a general way. We are always glad, however, to furnish plans for foundations with Raymond Concrete Piles, upon receipt of the general foundation plans, with complete data as to soil conditions, loads to be carried, etc. We will also, upon request, send a representative anywhere at any time, at our own expense, to figure on prospective work.

Equipment.

The necessary equipment for constructing concrete piles by the Raymond Pile Core Method consists of the following:

1. A strongly built pile driver, having a spread between the leaders of not less than 22½", and preferably fitted with turn-table, extension leaders and steam hammer.

2. A pile core of the size and length necessary for the work in hand.

3. Sheet steel for making shells—usually No. 20 gauge, although No. 18 gauge is sometimes used.

4. A heavy cornice brake for forming the sheet steel, together with the usual complement of shears, mallets, etc., for cutting and seaming the same.

Specifications for Raymond Concrete Piles.

We are frequently requested by Architects and Engineers who wish to be certain of securing satisfactory concrete pile work, to submit a specification for Raymond piles. If "Raymond Concrete Piles" are called for, this is, of course, sufficient. If, however, it is for any reason undesirable to name them specifically, the following points should be covered:

The use of a shell or form which remains in the ground, which is of sufficient strength and rigidity to withstand the back pressure of the soil after the driving form has been withdrawn, and which can be easily inspected to ascertain its condition before the concrete is placed in it.

No driving on the concrete.

Proportions for concrete: One part good Portland cement, three parts sharp sand, and five parts crushed stone or gravel which will pass a 1½" ring.

Concrete to be thoroughly mixed and carefully tamped in the shells as they are filled.

Among those who have used Raymond Concrete Piles are the following:

S. S. Beman, Architect, Railway Exchange Bldg., Chicago.

Frederick W. Perkins, Architect, Marquette Bldg., Chicago.

W. A. Otis, Architect, 175 Dearborn St., Chicago.

Ernest Flagg, Architect, 10 Wall St., New York City.

A. C. Cunningham, Civil Engineer, U. S. Navy, Washington, D. C.

E. C. & R. M. Shankland, Engineers, The Rookery, Chicago.

Patton & Miller, Architects, Hartford Bldg., Chicago.

Richards, McCarty & Bulford, Architects, Ruggery Bldg., Columbus, Ohio.

Laurence Ewald, Architect, 417 Pine St., St. Louis, Mo.

E. J. Yard, Chief Engineer, Denver & Rio Grande Ry., Denver, Col.

Esenwein & Johnson, Architects, Ellicott Sq., Buffalo, N. Y.

Jenney, Mundie & Jensen, Architects, New York Life Bldg., Chicago.

W. H. Lester, Engineer, Gulf Bag Co., New Orleans.

MacKenzie & Goldstein, Architects, New Orleans, La.

F. A. Burdett, Engineer, 29 W. 34th St., New York City.

Babb, Cook & Willard, Architects, 3 West 29th St., New York City.

F. P. Royce, Vice-Pres. Malden & Melrose Gas Light Co., Boston.

Ballinger & Perrot, Architects, Twelfth and Chestnut Sts., Philadelphia.

Barnett, Haynes & Barnett, Architects, St. Louis, Mo.

John Latenser, Architect, Bee Building, Omaha, Nebr.

Wm. Garstang, Sup. M. P. Big Four Ry., Indianapolis, Ind.

A. F. Groves, Architect, St. Louis, Mo.

Chas. S. Churchill, Chief Engineer, N. & W. Ry., Roanoke, Va.

Chas. R. Coates, Engr. Belknap Hdw. & Mfg. Co., Louisville, Ky.

Wm. F. Twining, Chief Engr. Philadelphia Rapid Transit Co., Philadelphia.

Cass Gilbert, Architect, New York City.

H. P. Padley, Engineer, C. St. P. M. & O. Ry., St. Paul, Minn.

Samuel Hannaford & Sons, Architects, Cincinnati, Ohio.

Mauran, Russell & Garden, Architects, St. Louis, Mo.

Cincinnati Gas & Electric Co., Cincinnati, Ohio.

South Buffalo Ry. Co., Buffalo, N. Y.

Abbot-Gamble Co., 32 Broadway, New York City.

Isaac A. Hopper & Son, Johnston Bldg., New York City.

F. L. Dame, General Electric Co., Schenectady, N. Y.

B. E. Holden, Architect, 175 Dearborn St., Chicago.

W. H. Wells, Engr. of Const. Southern Ry., Washington, D. C.

City Water Department, St. Louis, Mo.

F. S. Howell, Civil Engineer, Ellis Island, N. Y.

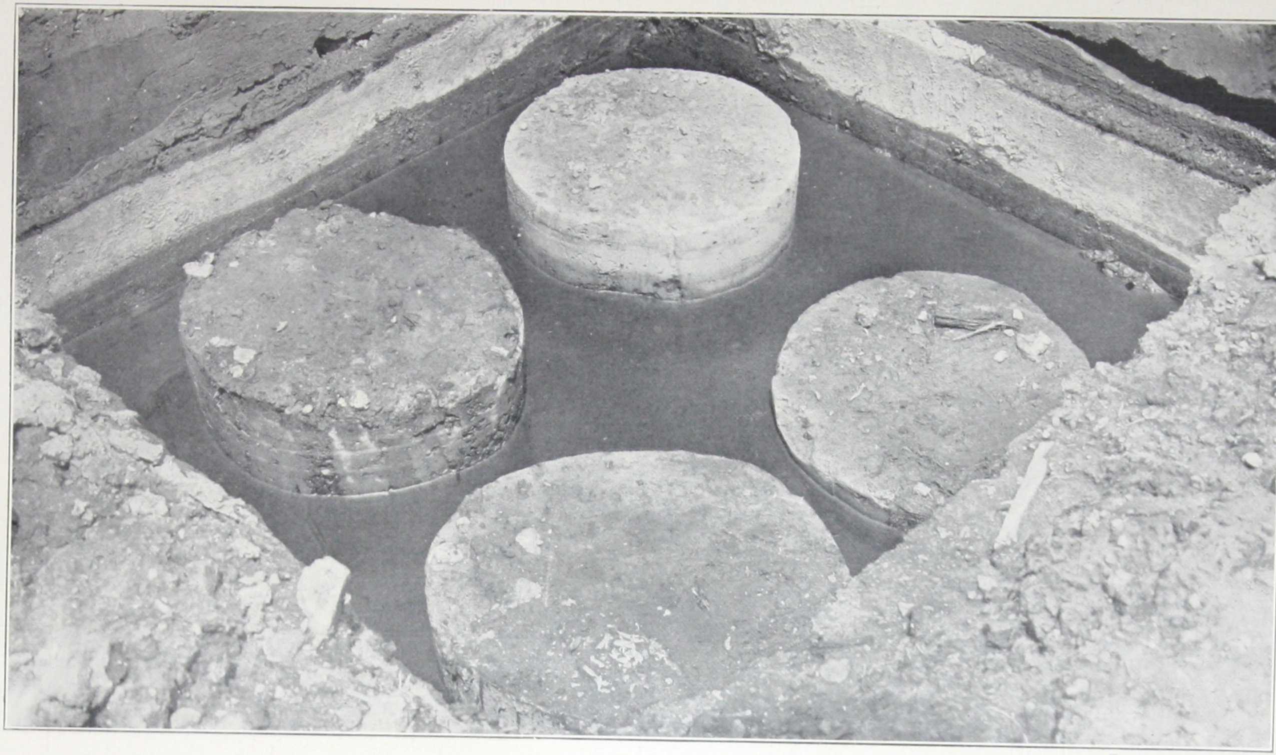
West Jersey & Sea Shore R. R. (Pennsylvania System), Westville, N. J.

Raymond Pile Core and Shell. A shell is driven for every pile and left in the ground to form a perfect mould for the Concrete.

Raymond Pile Core encased in shell, ready to be driven.

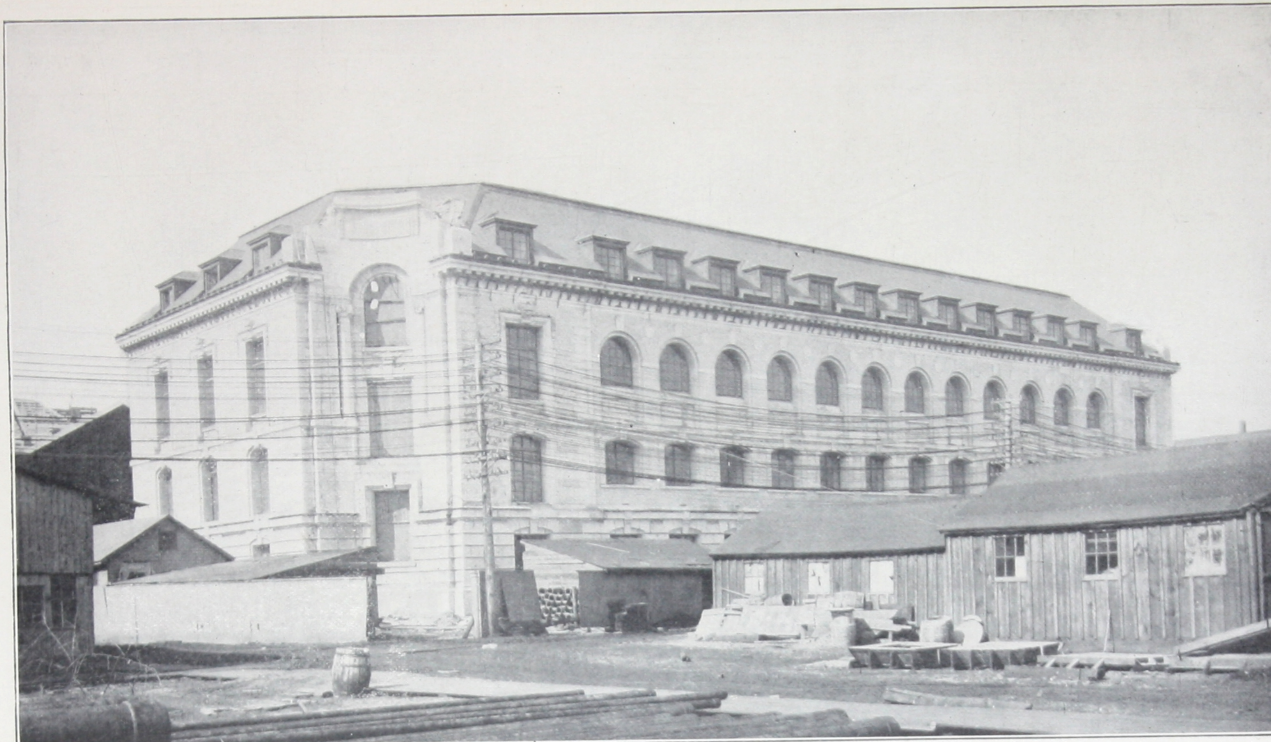
Raymond Pile Core and Shell fully driven. Core will be withdrawn and Shell filled with concrete. The shell makes it possible to see that the hole is a clean and perfect one, thus insuring a perfect pile. No working in the dark.

Making shells for Raymond Concrete Piles. Cornice brake for forming shells in background.



A pier of 20-inch Raymond Concrete Piles. Shell has been removed from the top 6 inches of the pile, so that it will have a perfect bond with the concrete of the footing.

Bryson Apartment Building, Lake Ave., Chicago. S. S. Beman, Architect. The first building to be built upon concrete piles. The architect is authority for the statement that there has been no settlement of this foundation.



Academic Building, Naval Academy, Annapolis, Md. Ernest Flagg, Architect, New York City. This is one of several buildings at the Naval Academy which were built on Raymond Concrete Piles. (See reprint from article by W. R. Harper on the last pages of this catalogue.)

Raymond Concrete Pile 22 feet six inches long, driven in sand and clay fill, soft bottom, weighted by Government Engineers in Academic site with 133,270 lbs. (See page 29.) Very slight settlement. This proves the advantage of a large, tapering pile over a straight pile.

JOHN PEIRCE,
PRESIDENT.
HENRY S. LANPHER,
V. PRES^T. & TREAS.
EMIL DIEBITSCH, C. E.
V. PRESIDENT.
WALTER ROBERTS,
ASST. TREAS.
PETER A. GAGE,
SECRETARY.

JOHN PEIRCE COMPANY

BROADWAY CHAMBERS. 277 BROADWAY

(TELEPHONE 3102 FRANKLIN)

NEW YORK May 24,1905.

Raymond Concrete Pile Co.,
135 Adams Street,
Chicago, Ill.

Dear Sirs:-

In regard to the concrete piles, which you drove for us in the foundation of the Academic Group of buildings at the U. S. Naval Academy, Annapolis, Maryland, we are very willing to bear testimony to the saving in labor, time and money due to the substituting of concrete piles for wooden piles in these foundations.

The original plans called for 2200 wooden piles cut off below low water with a capping of concrete - about 3300 cubic yards-to bring the foundations to grade. To get down to the low water level required sheet piling, shoring and pumping and the excavation of nearly 5000 cubic yards of earth.

By substituting your concrete piles the work was reduced to driving 850 concrete piles, excavating 1000 cubic yards of earth and placing 1000 cubic yards of concrete.

A comparison of quantities will give at a glance the saving in time and money achieved. The piles stood the severe test of the U. S. Government officials without the slightest indication of failure.

The foundations as built are eminently satisfactory to us, to the Architect and to the U. S. Government officers.

Yours truly,
John Peirce Company.
Emil Diebitsch
Vice-President.

A trench of Raymond Concrete Piles for the wall of the Crunden-Martin Woodenware Company's warehouse, St. Louis, Mo.

Free Public Library, Council Bluffs, Iowa. Built upon Raymond Concrete Piles. Patton & Miller, Chicago, Architects.

Office building and warehouse of Crunden-Martin Woodenware Company, St. Louis, Mo. Mauran, Russell & Garden, Architects. This is one of five buildings for which we put in concrete piles for the same owners and Architects.

MAURAN, RUSSELL & GARDEN,
ARCHITECTS,
CHEMICAL BUILDING,
ST. LOUIS.

CABLE ADDRESS
"MARGY ST.LOUIS."

May 23rd, 1905.

Raymond Concrete Pile Company,

135 Adams Street, Chicago.

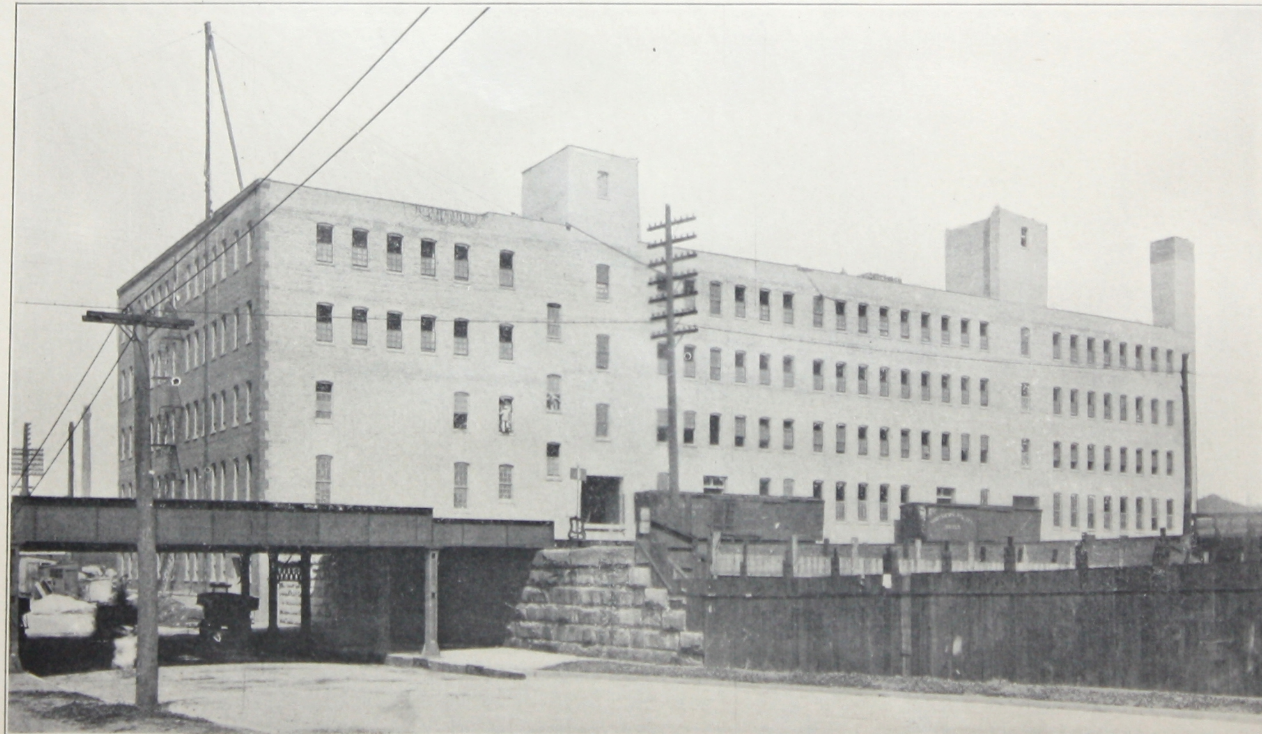
Dear Sirs:--

We take great pleasure in expressing to you our appreciation of the utility, effectiveness and structural character and quality of your concrete pile work installed at the Crunden-Martin Woodenware Company's new plant in this city. We have done considerable pile work in St. Louis and have found nothing which so thoroughly fits local conditions as your concrete pile.

We take pleasure in expressing also our appreciation of your courtesy and willingness to assist in overcoming difficulties. We deem the use of your piles effects a considerable saving over other similar forms of construction and the entire system has our commendation.

Very truly yours,

Mauran Russell & Garden.



Klotz Building, built for the Troy Laundry Machinery Company, Twenty-third and La Salle Streets, Chicago. Built upon 1,100 Raymond Concrete Piles. Jenny, Mundie & Jensen, Architects. (See Letter on page 35.)

JENNEY, MUNDIE & JENSEN
ARCHITECTS
1401 NEW YORK LIFE BUILDING
171 LA SALLE STREET
CHICAGO

W. B. MUNDIE
E. C. JENSEN
R. G. OWEN

TEL. {CENTRAL 1742
{AUTOMATIC 9701

SUBJECT:- Klotz Bldg.

Chicago, May 22, 1905

Raymond Concrete Pile Co.,

Gentlemen:-

Complying with your verbal request of today, we take pleasure in expressing our views in writing, of the concrete piles at the Klotz Bldg: When we first considered foundations for this building, we were faced with the bad condition of the soil which was very wet and soft and contained considerable quick sand. Inasmuch as it was unnecessary to put in a basement, we felt that it would be economy to use your concrete piles, which was done with economy and satisfactory results.

Yours respectfully,

Jenney, Mundie & Jensen,
By E. C. Jensen

Warehouse of the Eldridge & Higgins Co., Marietta, Ohio. Raymond Concrete Pile foundation. Richards, McCarty & Bulford, Columbus, Ohio, Architects. (See letter on page 37.)

RICHARDS · McCARTY · & BULFORD ·
· ARCHITECTS ·
· RUGGERY BUILDING · COLUMBUS · O ·

May 19th, 1905.

Raymond Concrete Pile Co.,
135 Adams St.,
Chicago, Ill.

Gentlemen:-

Replying to your inquiry of the 18th, would say, it affords us pleasure to state, that the concrete piling you put in for us under the foundation of the Eldridge & Higgins Company's warehouse at Marietta, Ohio, has proven perfectly satisfactory in every respect.

We were confronted when we began the construction of this building with a very serious proposition. It was located on filled ground over what had formerly been a swamp. We could not use wood piling on account of the fact that we could not get it below the water level. After careful investigation we concluded to try your piling and the result has been extremely satisfactory. We consider that the use of your piling has saved us at least $3000 in concrete work. The building has been in use for several months, is heavily loaded and there is not the least indication of a settlement in any part of it, although about one half of the building is on piling and the other half on solid ground outside of the limits of the filing and the swampy soil. We consider this even a better test than had the foundation been uniform over the entire area.

We shall bear you in mind for future work and if we can be of any service to you at any time we would be glad to do so.

Yours very truly,

RICHARDS, McCARTY & BULFORD.

Per. C E Richards

CER/C.

Statler Hotel, Buffalo, N. Y. Esenwein & Johnson, Architects. Built on Raymond Concrete Piles. (See letter on page 39.)

ESENWEIN & JOHNSON
ARCHITECTS
777-787 ELLICOTT SQUARE

BUFFALO, N. Y.

Sept. 29, 1906.

Raymond Concrete Pile Co.,
135 Adams Street,
Chicago, Ill.

Gentlemen:-

It gives us great pleasure to answer your letter of Sept. 21st.

You have given great satisfaction to the architects, to the owner and to the general contractors in performing your work

Your system is without any question an excellent one, and we would gladly recommend the same to any one you refer to us.

You had to work under a great disadvantage here, owing to shaky buildings in the neighborhood, and the nature of the ground, and many other things, and we thank you, therefore, that you have not tried to take advantage of the situation and charge any extras, although you have lost a great deal of time in waiting.

Respectfully yours,

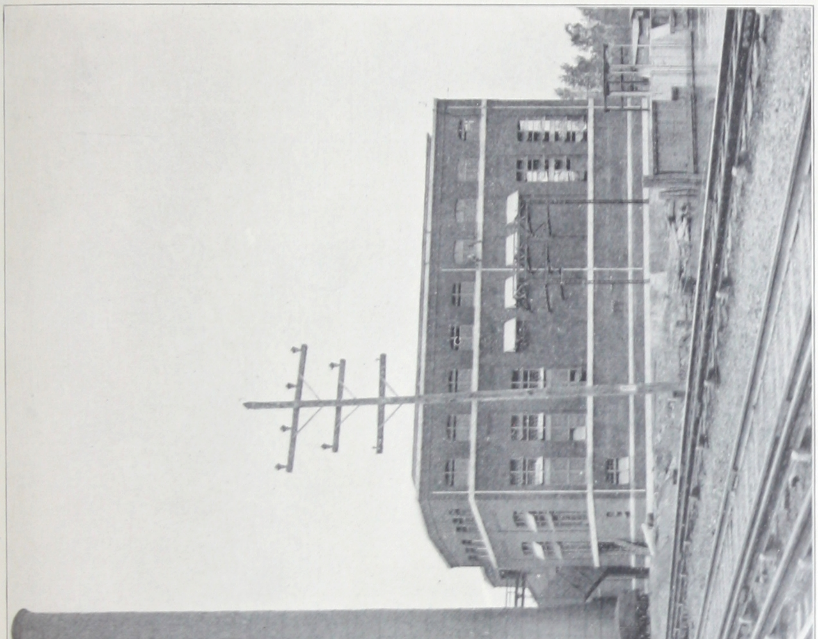
Esenwein & Johnson

ACE/KFB

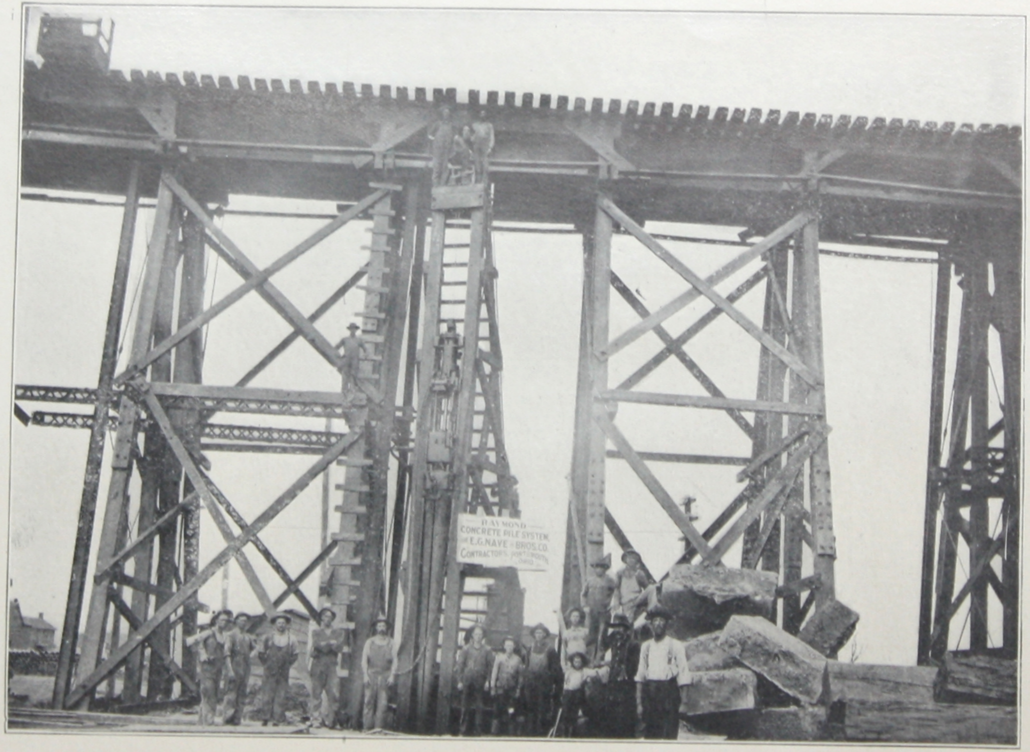
Frazee-Potomac Laundry, Washington, D. C. Built on Raymond Concrete Piles. Ambrose B. Stannard, General Contractor.

Stack foundation, Power House, West Jersey & Seashore R. R. Co. (Pennsylvania R. R. System), Westville, N. J. The Scofield Company, Philadelphia, Contracting Engineers.

Foundation piles, Power House, West Jersey & Seashore R. R. Co. (Pennsylvania R. R. System), Westville, N. J. The Scofield Company, Philadelphia, Contracting Engineers.

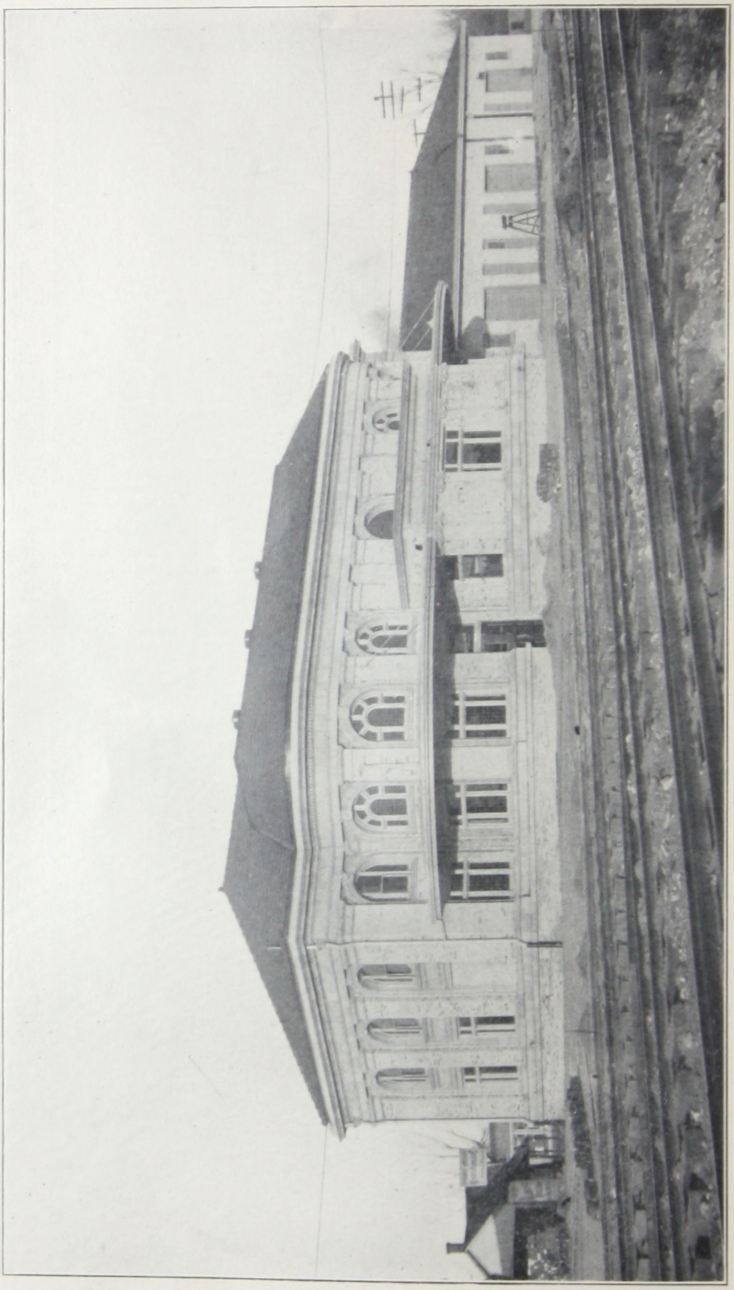


Power House of West Jersey & Seashore R. R. Co. (Pennsylvania R. R. System), at Westville, N. J. 850 Raymond Piles used. See Engineering News of November 8, 1906.

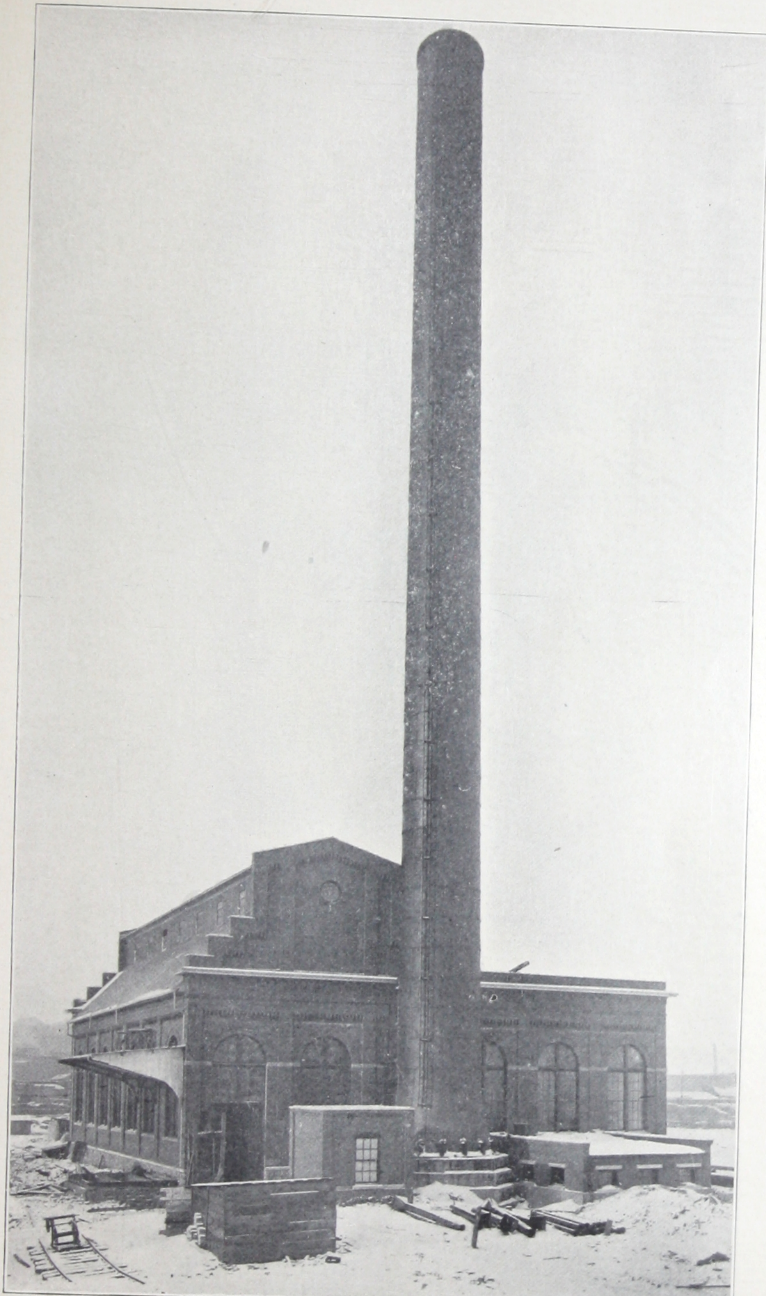


Placing Raymond Concrete Piles under pedestals of 2,200-foot viaduct of Norfolk & Western Railway at Kenova, W. Va. Work was done without interruption to traffic.
Charles S. Churchill, Chief Engineer.

Viaduct of Norfolk & Western Railway at Kenova, W. Va., 2200 feet in length. Raymond Concrete Piles under each pedestal. Chas. S. Churchill, Chief Engineer.



Station of Denver & Rio Grande Railway, Grand Junction, Colo. E. J. Yard, Chief Engineer. Built on Raymond Concrete Piles.



Power station of the Union Electric Company, Dubuque. Stack rests upon fifty 20-ft. Raymond Concrete Piles. 518 Raymond Piles under the building. E. C. & R. M. Shankland, Engineers.

New reinforced concrete building of the Gulf Bag Company, New Orleans, La. W. H. Lester, Engineer. Use of Raymond Concrete Piles in place of wood piles saved about 25 per cent of the cost of this foundation. (See letter on page 49.)

COR ALEXANDER AVE & STANLEY ST

BEMIS BRO. BAG CO.

IMPORTERS & MANUFACTURERS

BURLAP AND COTTON BAGS.

Winnipeg, Man. Oct. 26th/06. 190

Raymond Concrete Pile Co., ,

Chicago, Ill.

Gentlemen:-

I have copy of letter from Gulf Bag Co. New Orleans, in which you ask for testimonial regarding your tapering pile. I take pleasure in saying that we believe your pile is far superior to any other concrete piles, we also, believe it is the best pile for New Orleans soil generally. The large taper of your pile gives the best possible form for obtaining the carrying capacity required, and we recommend it in preference to all others.

Yours truly,

W. H. Lester

Salem Laundry of G. L. Hooper & Son, Salem, Mass. Built on Raymond Concrete Piles. Ballinger & Perrot, Philadelphia, Architects & Engineers. (See letter on page 51.)

WALTER F. BALLINGER EMILE G. PERROT

Established 1878 by GEISSINGER AND HALES

EDWARD M HALES
Consulting Architect

Specialists in the Designing of Industrial Plants, Reinforced Concrete Fire-Proof Buildings, Institutional Buildings.

BALLINGER & PERROT

FORMERLY HALES & BALLINGER

Architects and Engineers

Southwest Cor. Chestnut and Twelfth Streets Both Phones

PHILADELPHIA. Sept. 27, 1906.

Raymond Concrete Pile Company,

135 Adams St., Chicago, Ill.

Gentlemen:-

We congratulate you upon the promptness with which you have executed your work of putting in about thirty-four hundred lineal feet of Raymond Concrete Piles for the foundations of the Laundry Building for G. L. Hooper and Son, Salem, Mass. For conditions such as existed at this building, where good bearing soil was at a considerable distance below the su rface, we believe that piles of this type are the most economical and durable for the purpose that could be used.

Yours truly,

Ballinger & Perrot

WRF/K

Essex Building, St. Paul, Minn. Built on Raymond Concrete Piles. Cass Gilbert, Architect. Geo. W. Oakes & Co., Contractors. (See letter on page 53.)

CASS GILBERT.
ARCHITECT.
79-85 WALL STREET.
NEW YORK.
ENDICOTT B'LD'G
ST. PAUL, MINNESOTA

ST. PAUL, Feb. 27, 1906.

Raymond Concrete Pile Co.,
135 Adams St.,
Chicago, Ill.

Dear Sirs:-

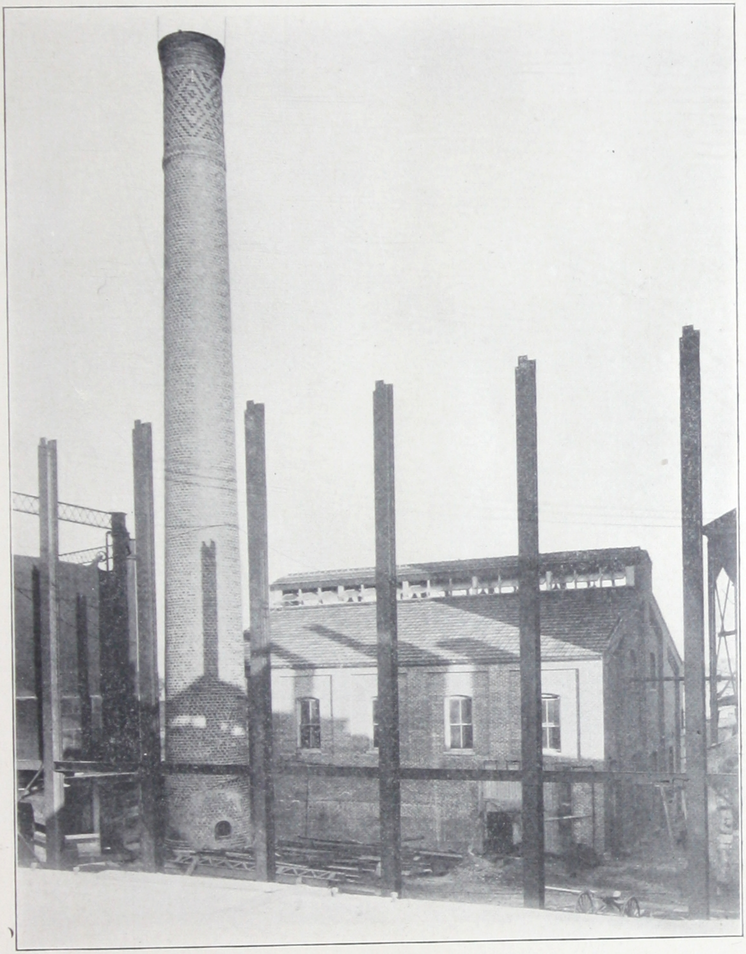
Answering your letter of February 6th, in reference to Raymond concrete piles used in the Essex Building, this city, would say that they have served the purpose admirably. I consider them very useful in a case such as ours where the ground is soft and the water level considerably below the bottom of footings. The saving of time and expense was no small item, their form and size making fewer piles necessary and thereby reducing the danger to adjacent buildings, some of which were in rather a shaky condition. I am glad of the experience obtained in their use and would use them again under similar circumstances.

Yours truly,

Cass Gilbert.

Per G. H. Kearsley

Building of the United States Express Company, West Twenty-third Street, New York City. Ernest Flagg, New York, Architect. Built upon Raymond Concrete Piles.



Boiler House and Stack for Malden & Melrose Gas Light Co., Malden, Mass. Built on Raymond Concrete Piles.

Building for American Hoist & Derrick Company, St. Paul, Minn. Built on Raymond Concrete Piles. Geo. W. Oakes & Co., Contractors.

Driving Raymond Concrete Piles for foundation of new corridor for hospital, U. S. Immigrant Station, Ellis Island, New York.

Residence of Duncan Joy, Esq., St. Louis, Mo. Laurence Ewald, Architect. (See letter on page 59.)

LAURENCE EWALD
ARCHITECT
417 PINE STREET SAINT LOUIS

St. Louis, Oct.11th, 06.

Raymond Concrete Pile Co.,

125 Adams St.,

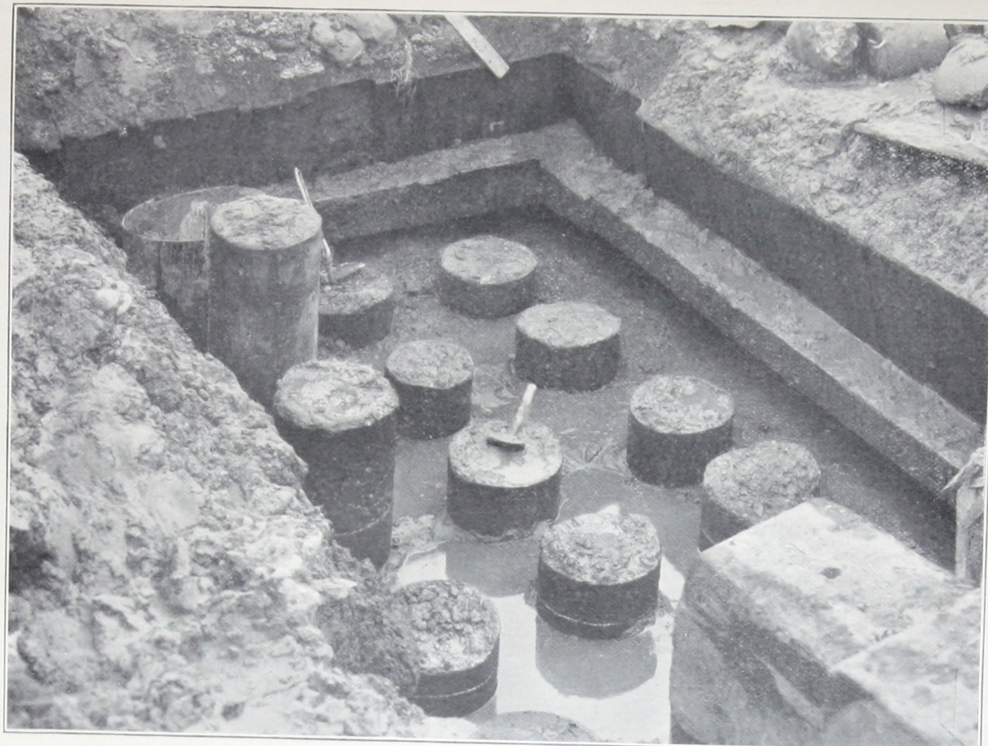
Chicago.

Gentlemen,

The concrete pile foundation which you put in the residences in Lenox Place of Duncan Joy and Lee Benoist are satisfactory in every way. They cost only half as much as the concrete or stone foundations carried to solid earth of similar residences in the same location.

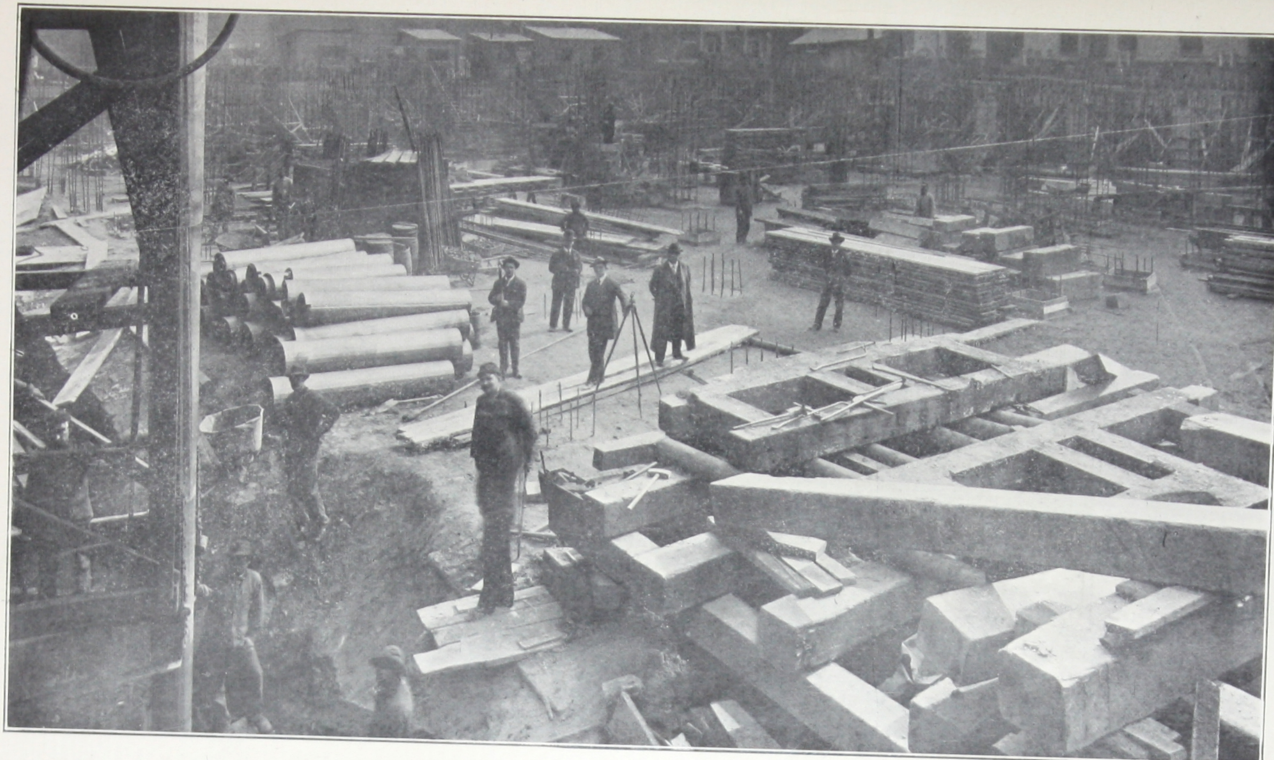
Yours truly Laurence Ewald

Residence of Lee Benoist, Esq., St. Louis, Mo. Laurence Ewald, Architect. (See letter on page 59.)



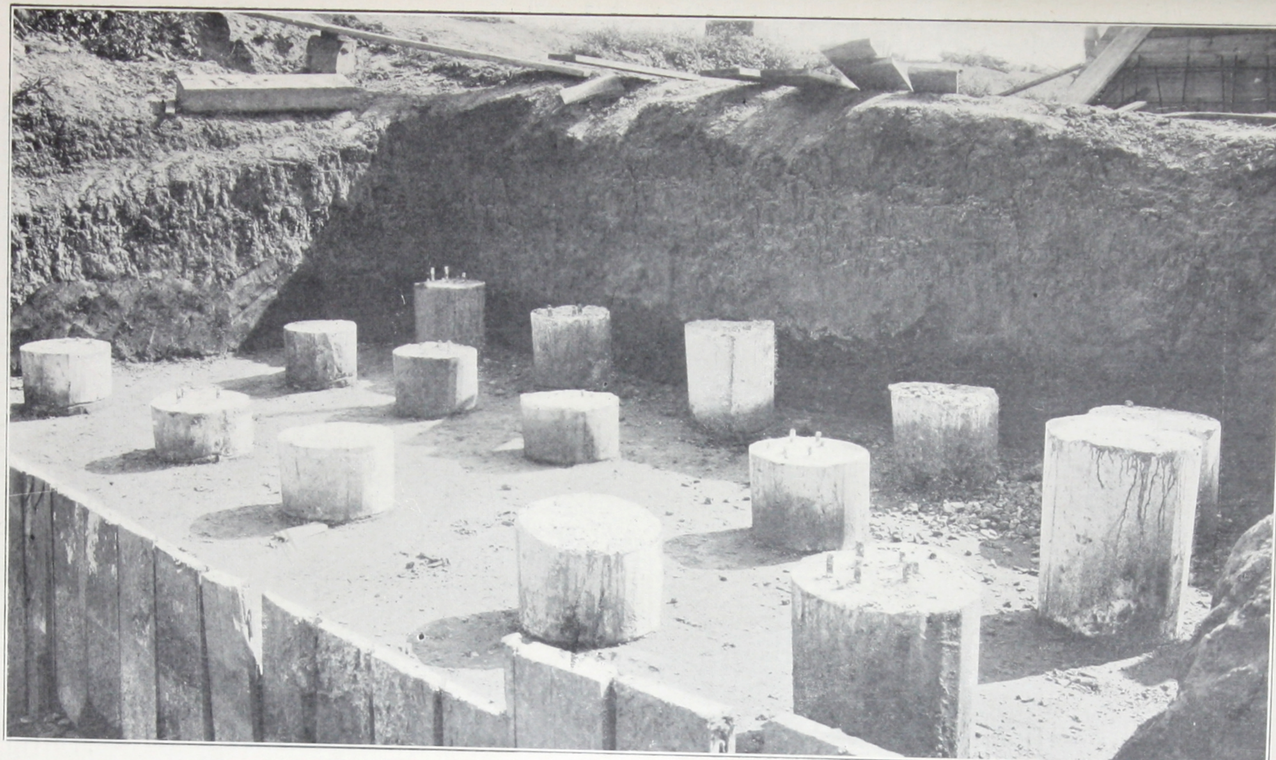
Pier of 18 Raymond Concrete Piles in foundation of Philadelphia Rapid Transit Company's Power House, Philadelphia. Designed to carry a load of 615 tons. W. S. Twining, Chief Engineer.

Pier of 4 piles, carrying a test load of 160 tons. Power House, Philadelphia Rapid Transit Company, Philadelphia. W. S. Twining, Chief Engineer.

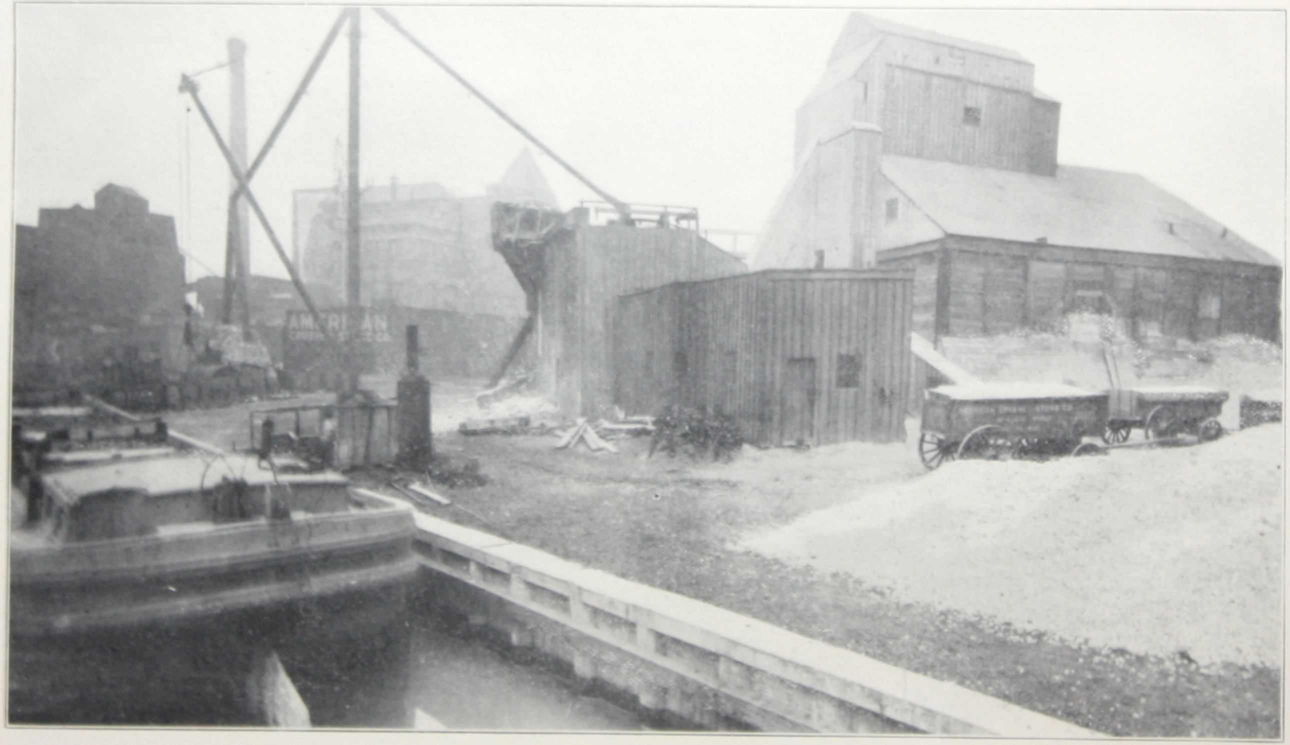


Foundation of nine-story reinforced concrete warehouse for the Belknap Hardware & Mfg. Co., Louisville, Ky. 1330 Raymond Concrete Piles used. Charles R. Coates, Engineer. The Oliver Company, General Contractors.

Placing Raymond Concrete Piles for foundation of the Lindeke, Warner & Sons Building, St. Paul, Minn. Louis Lockwood, Architect. Geo. W. Oakes & Co., Contractors.



Foundation for part of one of the settling basins for Water Department, City of St. Louis, Mo. Note the reinforcement in these piles.



Reinforced concrete dock for the American Crushed Stone Company, on the Chicago River, Chicago, Ill. Raymond Concrete Piles used. Note the wooden walling, which is backed by heavy car springs to absorb the shock of vessels.
(See letter on page 67.)

TELEPHONE MAIN 1112

AMERICAN CRUSHED STONE CO.
MANUFACTURERS OF
CRUSHED LIMESTONE
AND DEALERS IN
CRUSHED GRANITE AND PAVING MATERIALS
STREET PAVING CONTRACTORS
92 LA SALLE STREET

CHICAGO November 19th, 1906.

Raymond Concrete Pile Co.,

135 Adams St., City.

Gentlemen:-

With reference to your inquiry as to the concrete dock put in by your Company at our plant early last Winter, we are pleased to say that we are thoroughly satisfied with it in every particular.

In our opinion it is vastly superior to the heaviest wooden piling because it combines at least equal strength with imperishability.

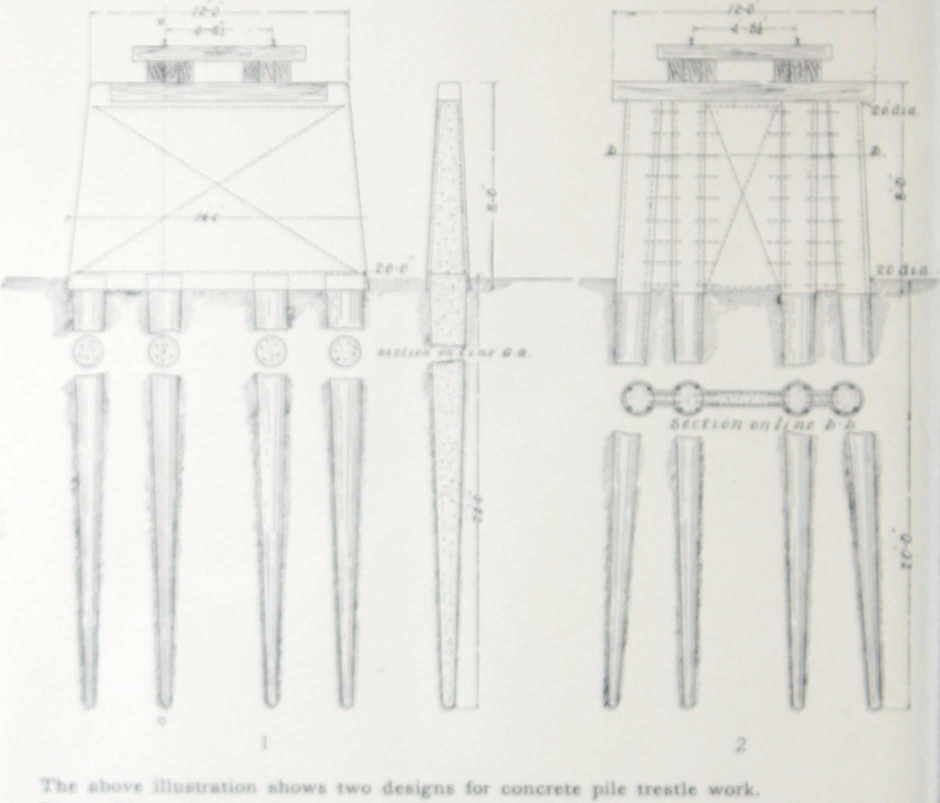
The work was well executed and has fulfilled both our expectations and your representations.

Very truly yours,

AMERICAN CRUSHED STONE COMPANY.

By Wm Kissack President.

(See letter on page 67.)



1 2

The above illustration shows two designs for concrete pile trestle work.

Fig. 1 Shows Raymond Concrete Piles to the surface of the ground and covered with a reinforced concrete pier.

Fig. 2 Shows reinforced Raymond Concrete Piles extending to desired height of trestle with wood or concrete cap securely bolted on top of piles. The piles are sway braced with a reinforced concrete web. The piles are 20 inches in diameter from the ground line up. In this construction the reinforcing rods run from near the bottom of the piles to the top, extending into the cap.

CONCRETE PILES

AT THE

United States Naval Academy

ANNAPOLIS, MD.

By

WALTER R. HARPER

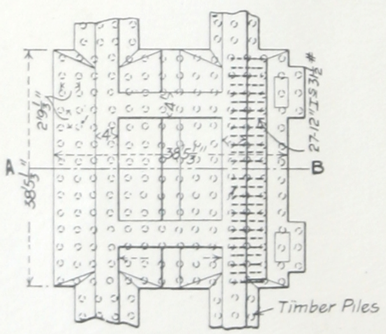
Inspector in Charge of the Academic Group, U. S. Naval Academy.

[*Reprinted from the Engineering Record, March* 4, 1905.]

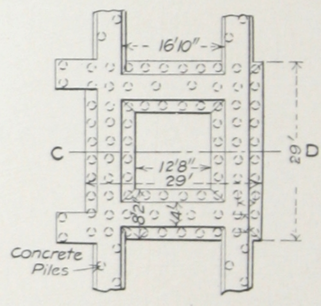
Concrete Piles at the United States Naval Academy.

By Walter R. Harper, Inspector in charge of the Academic Group, U. S. Naval Academy.

After the value of an efficient navy was made evident by the war with Spain, Congress made appropriations, from time to time, amounting to $10,000,000 to rebuild the Naval Academy at Annapolis, Md. The plans of Mr. Ernest Flagg, architect, of New York, were selected for the new academy. These plans contemplated a new sea wall, armory, seamanship building, midshipmen's quarters, gymnasium, hospital, chapel, officers' quarters, officers' mess building, steam engineering building, power house and academic group.



Plan



Plan

The academic group, the foundations of which are the subject of this article, consists of the library building, of granite and brick, about 150x133 ft., three stories high, with a central tower about 140 ft. in height containing a revolving dome for astronomical work. On one side of the library is a wing known as the physics and chemistry building and on the other the academic building. These two wings are also of granite and brick and nearly of the same design, three stories in height and about 229x84 ft. each. This group, taken as a whole, is one of the largest buildings in the country devoted to educational purposes.

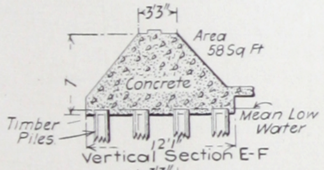
The soil on the site of the physics and chemistry building was of such a nature that piles were not required, but they were necessary under both the library and academic buildings, a portion of this land having been reclaimed from the Severn River by filling with sand and mud by means of dredges, three years previous to the beginning of these foundations.

Certain amounts of the appropriation were allotted to the various buildings. When the bids for the academic group were opened, the lowest, that of John Pierce, of New York, was found to far exceed the $1,500,000 allotted for the group, and some method had to be resorted to which would reduce the cost and still preserve the general plans of the buildings. Concrete piles were suggested, and upon investigation it was found that by their substitution for the wood piles shown in the original plans, the cost would be reduced about $27,000. Owing to the fact that wood will decay rapidly if not permanently covered with water, it is necessary to cut wood piles off at mean low water, and the concrete footings must start from this point and be carried up to the height of the bottom of the walls. With concrete piles the tops are left just far enough below the bottom of the walls to allow

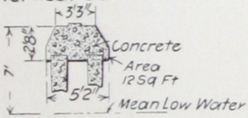
for a concrete beam thick enough to carry the weight of the building.

This difference in thickness of concrete footings is well illustrated by a section of the footings of the academic building with wood piles and the same section as redesigned and built with concrete piles. This saving in excavation and footings depends upon the height of the building above mean low water. At the Naval Academy the rise and fall of the tide in the Severn River is very slight, consequently the buildings have been placed only a few feet above mean low water. Notwithstanding that the cost per lineal foot for concrete piles far exceeds that of wood piles, being about four times as much, the saving in the entire foundation by their use will surprise the uninitiated, as will be seen by a glance at the cuts shown here.

In the accompanying diagrams the section E-F shows the footing of the connection between the library and academic building as designed by Mr. Flagg for wood piles. Another sketch shows the same section, G-H in the diagram, as built with concrete piles. The depth of footing on this section was reduced from 7 ft. to 2 ft. 8 in., and the width on the bottom from 12 ft. 1 in. to 5 ft. 2 in. The area of the cross-section



Vertical Section E-F



Vertical Section G-H

was reduced from 58 to 12 sq. ft. In the plan of the wood piles under the library tower there are 202 piles in a rectangle 38 ft. 5 1-3 in. square. The plan of the same tower foundations with 84 concrete piles has footings 8 ft. 2 in. wide.

With wood piles it will be noticed that the piles and footings extend over the entire rectangle, while with concrete piles the piles and footings are only 8 ft. 2 in. wide and directly under the walls of the tower. The depth of the footing was reduced by the use of concrete piles from 10 ft. 1 1-2 in. to 4 ft. 7 1-3 in. Twenty-seven 12-in. 31 1-2-lb. I-beams were done away with.

The following reductions on the foundations of the two buildings were made by the use of concrete piles: 2,193 wood piles were replaced by 885 concrete piles; 4,542 yd. of excavation were reduced to 1,038 yd., saving 3,504 yd., and 3,250 yd. of concrete footings were reduced to 986 yd., saving 2,264 yd.

With wood piles, after excavating to mean low water, shoring and pumping would have been necessary in all trenches, and this saving was estimated at $4,000. A schedule of changes showing the saving by the use of concrete piles is given in Table 1.

TABLE I.—COMPARATIVE COST OF WOOD AND CONCRETE PILES.

Wood Piles.			
2,193 piles	at	$9.50	$20,835.50
4,542 cu. yd. exc'vtn	"	.40	1,816.80
3,250 " concrete	"	8.00	26,000.00
5,222 lb. I-beams	"	.04	208 88
Shoring and pumping			4,000.00
Total cost			$52,861.18
Concrete Piles.			
855 piles	at	$20.00	$17,100.00
1,038 cu. yd exc'vtn	"	.40	415.00
986 " concrete	"	8.00	7,888.00
Shoring and pumping			----------
Total cost			$25,403.00
Difference in cost			$27,458.18

The saving in the cost of foundations by the use of concrete piles was $27,-458.18, or more than half of the original cost of the foundations as designed with wood piles.

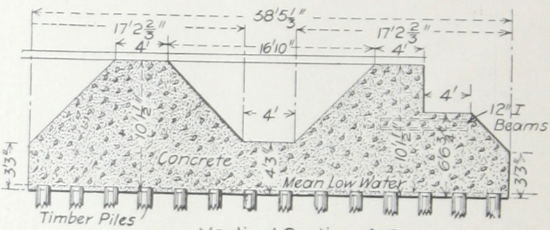
The estimate of length of wood piles was taken from the length of wood piles driven in the marine engineering building, a structure about 200 ft. from the library site. Wood piles would have been required 40 ft. in length at a cost of 20

cents a foot, and would have been on average driven 30 ft. below mean low water, which at 5 cents a foot would mean an average cost of $9.50 per pile.

For the estimate for excavations it was assumed that the entire site was at an elevation of 7 ft. above mean low water, which is an average of the existing conditions.

The longest concrete pile driven was 29.7 ft., but owing to the solid nature of the soil at the southerly end of the library building, where shorter piles were used, the average length was 16 ft., and the cost of the concrete piles was taken at $20 per pile.

The concrete pile selected was that of the Raymond Concrete Pile Co., of Chicago. It is conical in shape, running from 6 in. in diameter at the bottom to 20 in. at the top. Owing to this conical shape the ground is compacted and a much shorter pile can be used with this style than with a cylindrical pile. The difference in bearing power between a conical and cylindrical pile was shown by an experiment tried on this work at the Naval Academy. A Raymond pile core tapered from 6 in. at the point to 20 in. at the head, was driven 19 ft. until the penetration under two blows from a 2,100-℔. hammer falling 20 ft. was 7-8 in. A wood pile 9 1-2 in. at the point and 11 in. at the head and having the same length, 19 ft., as the conical pile, had a penetration of 5 5-16 in. under two blows of the same hammer, falling 20 ft. This pile was driven after the concrete pile and about 2 ft. from it, thus showing the comparative bearing power between a conical and a cylindrical pile of the same length.



Vertical Section A-B

These piles of the Raymond style are driven by the use of a hollow steel core 6 in. in diameter at the point and 20 in. at the head. The cores used on this work were 20 and 30 ft. in length. The exterior pieces of the core are spread and held in place during the driving by a wedge device. The core is held in the leads of the pile driver by steel plates, fastened to its top, which form guides to slide in the heads. The top of the steel core is protected by a hard wood cap-block which sets in a cavity made for it. This block receives the blow of the hammer and has to be renewed from time to time.

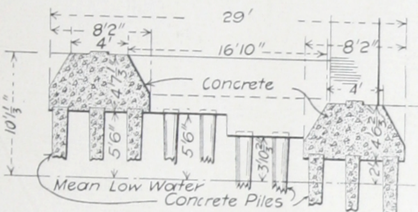
The sheet-steel shells are formed on the work in an extra heavy cornice brake machine, and are made in 8-ft. sections with locked seams. The sections are telescoped, the point of the core is raised about 8 ft. and inserted in the smallest section; then the other sections are drawn up around the core by a line from the hoisting engine on the driver.

Two drivers were used on the work at the Naval Academy, one with a 2,240-℔. drop hammer and the other a steam hammer of the Vulcan make, weighing 3,000 ℔s. The steam hammer was found more satisfactory, working much more rapidly. This was partly due to the fact that the steam hammer was mounted on a turn-table, and was able to turn in a circle by its own power. It was also provided with an extension top by which the core could be raised, or lowered, if necessary, in a trench below the driver.

The first piles were driven until twenty blows with the steam hammer caused a penetration of 1 in. This was found to be very severe on the steel core, and later tests on loaded piles proved that it was unnecessary to have such a small penetration, and it was reduced to eight blows for a penetration of 1 in.

When the driver with the drop hammer was brought on the work some comparisons had to be made between the

blows of the two hammers, so that the cores would be driven to the same penetration, to give an equal bearing for all parts of the building. A core was driven with the steam hammer until the penetration with eight blows was 1 in. This core was detached from the leads of the steam hammer and left standing in the ground; then the driver with the drop hammer was moved up and four blows from the 2,240-lb. hammer falling 20 ft. was found to drive it 1 in., or a penetration of 1-4 in. for a blow. As previously stated, eight blows of the steam hammer in rapid succession drove the core 1 in., and the conclusion was reached that one blow of the drop hammer was equivalent to two blows of the steam hammer.



Vertical Section C-D

The tests were made by loading the piles, and it was estimated that all piles with the same penetration as the test piles would have the same bearing power. A 17 1-2-ft. pile driven with a 20-ft. core, 6 in. in diameter at the point and 20 in. at the head, having a penetration of 1 in. under twenty blows of the steam hammer, was loaded with 41 tons. Levels were taken during the loading and at intervals for one month. At the end of the month the total settlement was 0.007 ft., or 3-32 in.

Another 28 1-2-ft. pile driven with a 30-ft. core, 6 in. at the point and 20 in. at the head, had a penetration of 5-16 in. under ten blows with the steam hammer. This pile was loaded with 42 tons. Levels were taken during the loading, showing a settlement of 0.002 ft., and at intervals for one month, showing no additional settlement. This pile was driven outside of the old sea wall in that portion of the land reclaimed from the Severn River, which had been filled with sand and mud three years previously.

A test pile was driven at the northerly end of the building on that part of the ground reclaimed from the Severn River. This pile was driven with a 30-ft. core a distance of 22 1-2 ft., having a penetration of 1 in. for eight blows with the steam hammer. The diameter of the pile was 6 in. at the point and 16 in. at the head. It was loaded with 41 tons and had a settlement of 0.007 ft., or 3-32 in. Ten days later it showed a total settlement of 0.009 ft. The load was then increased to 45 tons, with no additional settlement, and finally it was increased to 66 1-2 tons, showing a total settlement of 0.035 ft., or less than 7-16 in. There was no additional settlement when the load was removed six days later.

Table No. 2 gives the elevations taken on this pile during the month the test was being made.

It will be noticed that the pile rose about 1-8 in. when the load was removed. This difference was at first supposed to be an error in the level work, but was checked several times, giving the same result. This led to a study of past records on piles of other systems, and it was found that this rising after removing the test load had occurred on piles in various parts of the country. It was assumed to be due to the elastic nature of the soil.

In preparing the pile for a test a spike was grouted in the concrete top, then two double 12-in. I-beams were placed on top of the pile, leaving room enough between them for a level rod to be held on the spike. On the I-beam a platform was made of 12x12-in. beams 12 ft. long, projecting on either side. This platform was loaded with chain, leaving a hole in the center for the level rod. An elevation was taken on the spike before loading, and while the load was being applied, also at intervals for a month. These elevations were taken from a nearby bench mark.

The concrete was a 1:3:7 mixture

with Catskill Portland cement, sand and 1-8 to 3-4-in. gravel. The average of 78 neat cement Government tests was: Twenty-four hours, 308 ℔.; 7 days, 661 ℔.; 28 days, 745 ℔.

TABLE 2.—TEST ON CONCRETE PILE, ACADEMIC BUILDING, U. S. NAVAL ACADEMY.

Concrete mixture, 1 : 3 : 7. Length of core, 30 ft. Length of pile, 22½ ft. Diameter of pile head, 16 in. Diameter of point, 6 in. Penetration, 1 in. for eight blows No. 2 Vulcan steam hammer. Concrete 13 days old at beginning of test. Ground filled with sand and mud in 1901.

Date, 1904.	Load, tons.	Settlement: Since last reading.	Settlement: Total	
Sept. 1, noon	21	− 0.005	0.005 ft.	$=1/16$ in.
Sept. 1, 5:00 p. m.	31	− 0.000	0.005 "	$=1/16$ in.
Sept. 3	31	− 0.002	0.007 "	$=3/32$ in.
Sept. 14	31	− 0.000	0.007 "	$=3/32$ in.
Sept. 16	41	− 0.000	0.007 "	$=3/32$ in.
Sept. 26	41	− 0.002	0.009 "	$=7/64$ in.
Sept. 27	45	− 0.000	0.009 "	$=7/64$ in.
Sept. 28, 11:30 a.m.	50	− 0.004	0.013 "	$=5/32$ in.
Sept. 28, 3:30 p. m.	54	− 0.004	0.017 "	$=7/32$ in.
Sept 29	61	− 0.004	0.021 "	$=1/4$ in.
Oct. 1	66½	− 0.010	0.031 "	$=3/8$ in.
Oct. 4	66½	− 0.004	0.035 "	$=7/16$ in.
Oct. 10	66½	− 0.000	0.035 "	$=7/16$ in.
Oct. 26	0	+ 0.009	0.026 "	$=5/16$ in.

DEPARTMENT OF THE NAVY
BUREAU OF YARDS & DOCKS

WASHINGTON, D C

July 8, 1905

Raymond Concrete Pile Co.
Chicago, Ills.

Dear Sirs:

While stationed at the Naval Academy in connection with the work of improvement I supervised with much interest the placing of your concrete piles in the foundations of the Academic Group of

buildings.

The general description of this work as given by Mr. Walter B. Harper, C.E. in the Engineering Record, coincides with my observations.

Yours truly

A. C. Cunningham
Civil Engineer
U.S. Navy.